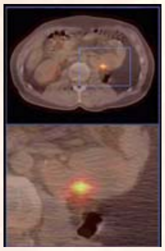
Minteq Pyrogenics Group

Pyroid® Pyrolytic Graphite Stripper Foil for High Energy Applications



Background:

Over the past decade, high energy radionuclide research and production using particle accelerators (cyclotrons) have become widespread. PET imaging alone, has seen dramatic shifts in utilization, as market adoption has moved from using nuclear cameras with coincidence detection to mobile and fixed PET and PET/CT scanners. PET imaging is now performed in more than 2,000 sites, using mobile and fixed PET and PET/CT scanners.

The increasing incidence of cancer, cardiovascular and neurological diseases means that demand for faster and more accurate diagnosis, as well as drug development and pre-clinical study efforts, will continue to accelerate radionuclide production in the coming years

Thin film carbon foils are used to strip electrons to produce this short lived, critical, radionuclide that is injected into the patient that enables the PET imaging process.

Efficient high energy research and radionuclide production starts with high performing carbon foils.

It is well understood that stripper foil lifetimes depend on the form of carbon used, the method of mounting, and their operating conditions.

The production of arc-evaporated foils and polycrystalline (PCG) graphite foils introduces impurities and lattice defects [1].

An examination was undertaken to compare free standing, Pyroid pyrolytic graphite (PG) stripper foils with alternative arc-evaporated carbon and PCG graphite foils using the services of an ISO Certified Laboratory Test Facility

Test Results:

Field Emission Scanning Electron Microscopy (FESEM)

FESEM was used to examine the free standing stripper foil samples from typical production runs for Pyroid PG, and commercially available arc-evaporated, PCG foils.

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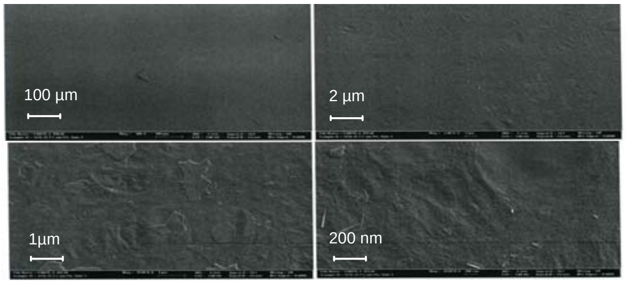

Figure 1) Pyroid Pyrolytic Foil
Areal Density 400 µg/cm^2

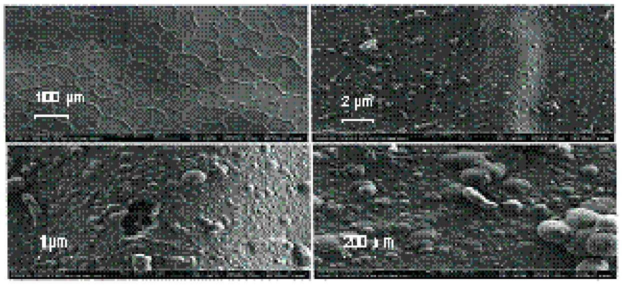

Figure 2) Arc-Evaporated Foil
Areal Density 250 µg/cm^2

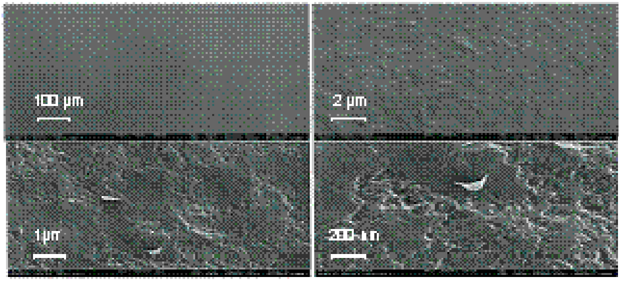

Figure 3) Pyroid Pyrolytic Foil
Areal Density 1000 µg/cm^2

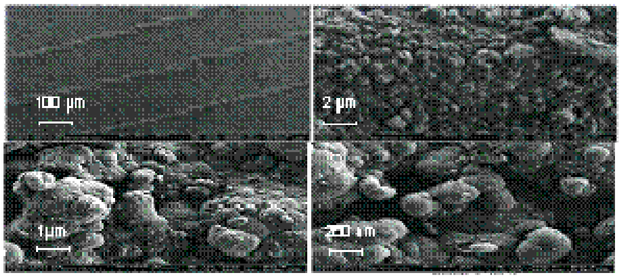

Figure 4) Arc-Evaporated Foil
Areal Density 1000 µg/cm^2

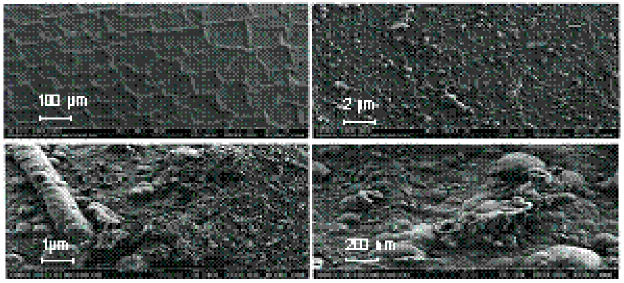

Figure 5) PCG Foil
Areal Density 1000 µg/cm^2

Figure 1 and 2 compare FSEM results of Pyroid PG stripper foil with an areal density of 400 µg/cm^2 with an arc-evaporated stripper foil with an areal density of 250 µg/cm^2.

Figure3, Figure 4 and Figure 5 compare FSEM results of Pyroid PG stripper foil with an areal density of 1000 µg/cm^2 with an arc-evaporated stripper foil and PCG foil with an areal density of 1000 µg/cm^2.

In each of these figures, the Pyroid PG foils yielded the most uniform physical appearance. They are generally featureless when compared with the commercially available competitive samples which exhibited significantly greater variability.

The arc-evaporated and PCG foils exhibit a course grain boundary like structure, and appear to have a raised surface.

It is also reported that non uniformity in composition can result in differential foil expansion under operation. Foils are typically mounted so that the central part is irradiated and experience high localized stress at the border of this irradiated zone [2].

The raised surfaces that appear in the arc-evaporated and PCG foils under FSEM, is hollow and introduces further stress risers under irradiation accelerating failure.

X-ray Diffraction (XRD) / Thermo gravimetric Analysis/ Differential Thermal Analysis (TGA-DTA)

Under analysis, Pyroid PG foils experience typical conical crystalline pyrolytic graphite structure with repeatable uniformity, consistency, and lack of non-graphitic species.

This contrasts with the arc-evaporated foils that show evidence of carbon like structure on the foil evidenced of annealing process.

In addition, the PCG foils contain approximately 25%, non-graphitic, low temperature organic(s) contamination.

Figure 6 indicates the results of typical TGA/DTA analysis between the sample foils. The Pyroid PG foils have 175 to 375 C higher temperature stability of over similar arc-evaporated and PCG foils.

A foil is destroyed quickly if its temperature rises to the point for which evaporation becomes significant or if melting occurs [3].

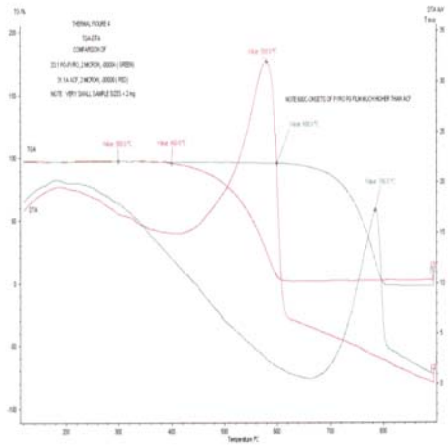

Figure 6) Typical TGA/DTA Comparison
Pyroid PG and arc-evaporated foils
Areal Density 250 - 400 µg/cm^2

Pyroid pyrolytic graphite stripper foils:

- **Highest Purity**
- **Highest Uniformity**
- **Highest Thermal Stability**

Best Choice for all High Energy Electron Extraction Applications

For Details or Samples
Call, FAX or Email

Toll Free: 800-962-8586 FAX: 610-250-3325

1) J.O. Stoner Jr., S.A. Miller, C. O. Jolivet, Nucl. Instrum. And Meth. A 590 (2008) 57-65.

1) J.O. Stoner Jr., C. O. Jolivet, Nucl. Instrum. And Meth. A 590 (2008) 51-56.

[2] C.J. Liaw, Y.Y. Lee, J. Tuozzolo, in: Proceedings of the 2001 Particle Accelerator Conference, Chicago, pp. 1538–1540.